

y los polluelos salieron de los nidos entre noviembre y diciembre. Los nidos fueron de construcción endeble y constituidos por ramas secas y se situaron en las bifurcaciones de las ramas de árboles a una altura promedio de 15 m sobre el suelo ($N = 3$). Las dimensiones promedio de los nidos fueron 39.5×39.5 cm y 13.9 cm de profundidad exterior, con una copa de 21.5×22.5 cm y 7.8 cm de profundidad. El tamaño modal de la nidada fue dos ($N = 3$ nidos). Los huevos presentaron manchas de color café con marcas más fuertes en la base ($N = 6$ huevos) y tuvieron un tamaño promedio de 51.5×40.8 mm ($N = 4$). Los polluelos eclosionaron de forma asincrónica. En total, de tres intentos de nidificación, dos polluelos emplumaron exitosamente, lo que representa un éxito de nidificación del 66.6%. Todas las presas llevadas a los polluelos en el nido fueron serpientes ($N = 9$).

[Traducción del equipo editorial]

ACKNOWLEDGMENTS

We thank Russell Thorstrom for an earlier review of this manuscript, Robson Silva e Silva for supplying reference material and literature, Jane Elce Scheid Ramos for help in the preparation of the manuscript, INMET—National Meteorology Institute (5° Meteorology District) for providing us with climatic data on the first studied area, and Dave Whitacre for his information, references, and review.

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Received 15 July 2003; accepted 19 September 2004

J. Raptor Res. 39(1):92–94

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COOPERATIVE NESTING BY A TRIO OF BOOTED EAGLES (*HIERAAETUS PENNATUS*)

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KEY WORDS: *Booted Eagle*, *Hieraaetus pennatus*; *cooperative breeding*; *polygamy*; *polygyny*; *trio*.

Although monogamy is the most common mating system among raptors, alternative systems like polygyny, polyandry, and cooperative breeding have been recorded in several species (Newton 1979, Korpimäki 1988, Stacey and Koenig 1990). A recent review on the topic showed

that this was a frequent phenomenon in well-studied species and that the mating system was probably not determined in many other species because of the difficulty in making appropriate observations and given the fact that many raptors have not been well studied (Kimball et al. 2003). Cooperative breeding has been observed among 3% of bird species, including at least 42 diurnal raptors (Brown 1987, Kimball et al. 2003).

Here, we report a case of cooperative nesting by a trio in an intensively-monitored breeding population (21–29 pairs) of Booted Eagles (*Hieraaetus pennatus*) in south-

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eastern Spain. Our observations were made in 2001 in a mountainous area of the Region of Murcia (southeastern Spain), characterized by large tracts of pine forests (*Pinus halepensis*) interspersed with smaller clearings of cultivated lands and scrubland. The Booted Eagle is a medium-sized, territorial raptor that nests on trees and rocky cliffs in forested areas of the Palearctic and sub-Saharan regions (del Hoyo et al. 1994). This species is considered a monogamous raptor (Newton 1979, Cramp and Simmons 1980) and to our knowledge no instances of trios at nests have been reported.

In the Iberian Peninsula, Booted Eagles are generally summer residents, arriving from their wintering grounds in late March and early April. In our study area, nest building or reconstruction occurs soon after the eagles arrive and their mean laying date is 24 April.

OBSERVATIONS

In 2001, during the pre-laying period, a polygynous trio was observed in one territory on the study area. The same territory was monitored in the previous year related to other research. This study in 2000 involved 195 hr of nest observations that allowed us to photograph and individually identify the pair composed of a pale-morph male (M1) and a dark-morph female (F1). This female was trapped and marked with a radiotransmitter mounted with a backpack harness. She laid two eggs and the pair reared two young successfully.

In 2001, when the trio was recorded, we observed the nest for 46 hr. The male who occupied this nest was the same male observed the previous year (M1) based on distinctive features of its plumage (blond head and neck, and white breast with numerous brown streaks). The previous year's female (F1) was identified because of the transmitter. The third bird in the territory was a pale morph individual identified as an adult (the adult plumage is acquired at the third calendar year; Forsman 1999) female (F2) due to its size and behavior. No copulations were observed between M1 and either female. Also, during the pre-laying period, no aggressive interactions between the three individuals were observed. Instead, all three eagles added material to refurbish the nest, although the bulk of this task was done by M1 (20%) and F1 (70%; $N = 10$ deliveries of nest material).

When the nest was checked on 29 April it was defended by the adults (M1 and F1), and contained two eggs. Both females were observed to incubate the eggs, although F1 spent more time (93%; $N = 540$ min) than the accompanying female (7%). We also observed the relief of F1 by F2 from the incubation on three occasions, which occurred when the former left the nest to participate in territorial defense, to hunt, or apparently to take a rest. In contrast, while F1 incubated, F2 perched on a nearby tree. Although F2 brought greenery to the nest, it was only F1 who situated the greenery in the nest.

During the nestling period, the two hatched young were only fed by F1, while F2 stood perched on a nearby

tree most of the time. The helper female (F2) was observed only twice with F1 in the nest. When the male approached the nest with prey, it emitted food-begging calls, which prompted calling from both females. F2 was never observed delivering prey to nest. On one occasion both females attacked a Common Raven (*Corvus corax*). The pair and the helper female successfully reared one young, who flew for the first time between 5–10 July 2001.

DISCUSSION

The above described case of apparent polygyny can be considered cooperative breeding because all the members of the breeding unit contributed to the care of a single nest (Kimball et al. 2003). We suggest that cooperative breeding in the Booted Eagle is uncommon because of the lack of reports in the scientific literature. Nevertheless, we must be cautious with this affirmation due to the difficulty in observing this kind of behavior, especially for a species with poorly known breeding biology, as is the case of the Booted Eagle (Veiga and Viñuela 1994, Suárez et al. 2000).

The presence of helpers at raptor nests has been associated with many factors, including productive habitats with abundant food supply (Van Kleef and Bustamante 1999), low prey densities (Doyle 1996), biased sex ratio in adults (Oring 1986, Arroyo and Garza 1986), the reduced availability of suitable sites for reproduction (Heredia and Donazar 1990, Bertrán and Margalida 2002), saturation of breeding territories (Heredia and Donazar 1990), potential benefits of group living (Garcelon et al. 1995, Kimball et al. 2003) and benefits to yearlings that gain breeding experience (Zuberogoitia et al. 2003). The Booted Eagle is a philopatric species (Cramp and Simmons 1980), thus a possible explanation is that the helper was an individual born in the study area some years ago and returned to its natal area for the first time. Whether the helper was recruited by the adults to assist with the breeding effort or was a previous offspring of the pair was unknown. Based on our limited observations, it was unclear which factors may have led to this cooperative breeding event. We encourage other observers working on Booted Eagles to make an effort to recognize individual breeders and that researchers should be aware of the possibility of cooperative breeding in this species.

REPRODUCCIÓN COOPERATIVA POR UN TRÍO EN *HIERAAETUS PENNATUS*

RESUMEN.—En esta comunicación se describe un caso de reproducción cooperativa por un trío poligínico de *Hieraaetus pennatus* en una zona forestal del sureste de España. El trío, observado en 2001, estaba compuesto por un macho de fase clara, una hembra consorte de fase oscura, y una hembra acompañante de fase clara. No se observaron cópulas. Ambas hembras colaboraron en las tareas de mantenimiento, incubación y defensa del nido

Sin embargo, la hembra consorte contribuyó mucho más en las actividades reproductivas que la hembra acompañante; ésta última no fue nunca observada trayendo presas al nido o cebando a los pollos con el alimento aportado por el macho.

[Traducción de los autores]

ACKNOWLEDGMENTS

We are indebted to Ginés Gómez and Martina Carrete for field assistance. We also thank Beatriz Arroyo, Javier Balbontín, Jim Bednarz, and one anonymous referee for helpful comments on the manuscript.

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Received 6 October 2003; accepted 27 July 2004

J. Raptor Res. 39(1):94–97

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TIMING AND ABUNDANCE OF MIGRANT RAPTORS ON BONAIRE, NETHERLANDS ANTILLES

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KEY WORDS: *American Kestrel*; *Falco sparverius*; *Swallow-tailed Kite*; *Elanoides forficatus*; *Yellow-headed Caracara*; *Milvago chimachima*; *migration*, *Caribbean*.

The island of Bonaire (12°10'N, 68°18'W) in the south Caribbean Sea, 87 km north of Venezuela, is the easternmost island of the Netherlands Antilles. Bonaire occupies a land surface of ca. 272 km², its climate is arid, and the island is largely covered in xerophytic and thorny bush and sparse woodland. Some 181 species of birds have

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